**BIOLOGICAL ASSESSMENT**
**FOR THE**
**OPERATIONS AND MAINTENANCE DREDGING AND DISPOSAL**
**FOR THE**
**MURRELLS INLET PROJECT**
**GEORGETOWN COUNTY, SOUTH CAROLINA**

**APRIL 2001**

## 1.00 INTRODUCTION

Murrells Inlet is located on the Atlantic coast in Georgetown County, approximately 80 miles north of Charleston, South Carolina and 12 miles south of Myrtle Beach, South Carolina (SC). The inlet is located between the south end of Garden City Beach (GCB) and the north end of Huntington Beach State Park (HBSP). Congress authorized the Murrells Inlet Navigation Project ("Project") in 1971. The Project as authorized consisted of the construction of two jetties and sand dikes to stabilize the inlet. It also authorized the dredging of a deposition basin with a capacity of 600,000 cubic yards (cy), an entrance channel 300 feet wide and 10 feet deep plus two feet of overdepth, an inner channel 90 feet wide and 8 feet deep with two feet of overdepth, and a turning basin 300 feet long and 150 feet wide. In addition, regular operation and maintenance (O&M) dredging, with disposal of material on GCB and HBSP was authorized. Construction was initiated by the U.S. Army Corps of Engineers, Charleston District (Corps) in 1977 and was completed in 1981. In May 1988, the Corps completed the only O&M dredging of the Entrance Channel, Inner Channel A, and the Deposition Basin since completion of the Project. The Inner Channel B and the Turning Basin have not been maintained since original construction due, in part, to a lack of suitable disposal areas.

A hydrographic survey performed by the Corps in October/November 2000 indicated a number of shoaled areas that need to be dredged in the previously authorized federal channels (see Figure 1). Since the 1988 O&M dredging, a sand spit has formed at the south end of GCB and has currently migrated into a portion of the federal channel (Inner Channel A). This sand spit has forced the navigation channel south and eastward from its original alignment in the inlet and closer to the terminal west end of the south jetty and HBSP. The U.S. Coast Guard has had to relocate channel markers to safely aid vessels navigating through the inlet. Further channel migration will continue to increase the likelihood of vessel groundings. Tidal current direction has been altered which is increasing erosion and endangering the shorebird habitat area on HBSP. This area was originally constructed by the Corps and also received dredged material during the 1988 O&M dredging operation. Further erosion, if left unchecked, will lead to instability along the south jetty foundation. For Project location and drawings refer to Figures 1-4, attached.

## 2.00 PROPOSED PROJECT

In order to address the above concerns, the Corps proposes to perform the O&M dredging of the Project as described in this BA. The Project involves hydraulically dredging (using a hydraulic pipeline cutterhead dredge) beach compatible material (sand) from the federal navigation channels and the deposition basin located near the north jetty. This work will dredge away a large portion of the sand spit at the southern end of GCB. The dredged material will be placed on the beach at GCB for protection of

existing structures, the shorebird habitat area at the terminal west end of the south jetty, and in the intertidal zone on the beach at HBSP. A testing plan for the physical and chemical analysis of sediments has been developed for the areas proposed for O&M dredging and will undergo review by State and Federal resource and regulatory agencies during the Draft Environmental Assessment (DEA) review process. The testing plan will include grain size, sediment chemistry and modified elutriate analysis. Information gained from this testing will determine if the material proposed for O&M dredging is suitable for beach disposal. This BA only addresses the O&M dredging and placement of beach quality material. No change in channel dimensions or locations is proposed for the authorized Project.

The areas proposed to be O&M dredged, along with the corresponding quantities and the order in which they will be dredged are as follows:

1. Deposition Basin - (approx. 420,000 cy)
2. Inner Channel B - (approx. 6,500 cy)
3. Inner Channel A - (approx. 195,000 cy)
4. Auxiliary Channel - (approx. 13,000 cy)
5. Entrance Channel - (approx. 75,600 cy)
6. Total - (approx. 706,000 cy.

The areas proposed for placement of the O&M dredged material (beach quality sand), along with the corresponding quantities and the order in which they will be dredged are as follows:

1. Garden City Beach (330,000 cy)
2. The terminal west end of south jetty and the shorebird habitat area (93,300 cy)
3. Intertidal zone on Huntington Beach (will vary from 140,000 cy to 280,000 cy).

It is expected that approximately 289,200 cy of O&M dredged material will come from the federal channels and approximately 420,000 cy of O&M dredged material will come from the deposition basin. The deposition basin will be dredged 18 feet deep plus two feet of allowable overdepth. O&M material disposed of on GCB will be used to enhance storm protection. The material will be spread and shaped by bulldozers and/or other equipment. The material disposed of at the terminal west end of the south jetty on HBSP will be used to restore shorebird habitat and to provide protection for the jetty foundation. The remaining O&M dredged material will be disposed of in the intertidal zone along front beach at HBSP to protect and enhance sea turtle nesting habitat and create potential critical habitat for the wintering piping plover. In addition, it may create potential new seabeach amaranth habitat while protecting existing wild populations and some recently created seabeach amaranth restoration areas on HBSP.

The proposed O&M work will be accomplished as soon as possible, subject to obtaining all the necessary environmental clearances. It is expected that the O&M dredging can be initiated no sooner than June/July 2001 and the work will require about 2-3 months for completion. This schedule could change due to contractual issues, inclement weather, mechanical failure, or other unforeseen difficulties.

Georgetown County has applied for a permit (P/N# 2000-1W-494-P) to repair groins and perform beach renourishment at GCB. This Project does not address the actual groin repair; however, the Project will supply the sand needed for the beach renourishment that will support the groin repair.

The maintenance dredging of the channels and the deposition basin in addition to the disposal of material will be repeated periodically to maintain the required depths for the Project as authorized. As noted above, the Charleston District is also currently preparing a DEA for the proposed Project.

## 3.00 PRIOR CONSULTATIONS

To our knowledge, no previous Section 7 formal or informal consultations occurred for the original Project, the 1988 O&M dredging or the proposed O&M dredging.

## 4.00 LIST OF SPECIES

### 4.01 U.S. Department of the Interior

The US Fish and Wildlife (USFWS) provided a list on February 12, 2001. The following species have been listed by the U. S. Department of Interior as occurring or possibly occurring in Georgetown County (from list dated November 16, 2000). For symbol key, see below:

E = Federally endangered
T = Federally threatened
PCH = Proposed Critical Habitat
C = The USFWS or the National Marine Fisheries Service (NMFS) has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species
S/A = Federally protected due to similarity of appearance to a listed species
SC = Species of concern. These species are rare or limited in distribution but are not currently legally protected under the Endangered Species Act.
* = Contact National Marine Fisheries Service for more information on this species

| Common Name | Scientific Name | Status | Occurrences |
|---|---|---|---|
| West Indian manatee | *Trichechus manatus* | E | Known |
| Finback whale | *Balaenoptera physalus** | E | Known |
| Humpback whale | *Megaptera novaeanqliae** | E | Known |
| Northern right whale | *Eubaleana glacialis** | E | Known |
| Sei whale | *Balaenoptera borealis** | E | Known |
| Sperm whale | *Physeter catodon** | E | Known |
| Bald eagle | *Haliaeetus leucocephalus* | T | Known |
| Red-cockaded woodpecker | *Picoides borealis* | E | Known |
| Wood stork | *Mycteria americana* | E | Known |
| Piping plover | *Charadrius melodus* | T/PCH | Known |
| Kemp's ridley sea turtle | *Lepidochelys kempii** | E | Known |
| Leatherback sea turtle | *Dermochelys coriacea** | E | Known |
| Loggerhead sea turtle | *Caretta caretta* | T | Known |
| Green sea turtle | *Chelonia mydas** | T | Known |
| Shortnose sturgeon | *Acipenser brevirostrum** | E | Known |
| Sea-beach amaranth | *Amaranthus pumilus* | T | Known |
| Canby's dropwort | *Oxypolis canbyi* | E | Possible |
| Pondberry | *Lindera melissifolia* | E | Possible |
| Chaffseed | *Schwalbea americana* | E | Known |
| Dusky shark | *Carcharhinus obscurus** | C | Possible |
| Sand tiger shark | *Odontaspis taurus** | C | Possible |
| Night shark | *Carcharhinus signatus** | C | Possible |
| Speckled hind | *Epinephelus drummondhayi** | C | Possible |
| Jewfish | *E. itijara** | C | Possible |
| Warsaw grouper | *E. nigritus** | C | Possible |
| Nassau grouper | *E. striatus** | C | Possible |
| Awned meadowbeauty | *Rhexia aristosa* | SC | Known |
| Bachman's sparrow | *Aimophila aestivalis* | SC | Known |

| Common Name | Scientific Name | Status | Occurrences |
|---|---|---|---|
| Carolina pygmy sunfish | *Elassoma boehlkei* | SC | Known |
| Carolina grass-of-parnassus | *Parnassia caroliniana* | SC | Known |
| Dune bluecurls | *Trichostema sp1* | SC | Known |
| One-flower baldunia | *Balduina uniflora* | SC | Known |
| Pindland plantain | *Plantago sparsiflora* | SC | Known |
| Pondspice | *Litsea aestivalis* | SC | Known |
| Reclined meadow-rue | *Thalictrum subrotundum* | SC | Known |
| Wire-leaved dropseed | *Sporobolus teretifolius* | SC | Known |
| Venus' fly-trap | *Dionaea muscipula* | SC | Known |

Species proposed for listing: None
Designated Critical Habitat: None in the area of this project
Proposed Critical Habitat: The U.S. Fish and Wildlife Service proposes to designate critical habitat under the Endangered Species Act of 1973, as amended (Act), for the piping plover (*Charadrius melodus*) on breeding grounds in the Great lakes and Northern Great Plains Regions, and in the wintering grounds along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. This proposed rule, if made final, would result in additional review requirements under section 7 of the Act. The Murrells Inlet project area is located in the South Carolina Piping Plover Critical Habitat Conservation Unit SC-3 (see Figure 5).

**4.02 The National Marine Fisheries Service**

The National Marine Fisheries Service provided a list (dated June 7, 1999) on February 12, 2001, indicating the following threatened (T) and endangered (E) species and critical habitats that are listed under that agencies jurisdiction of the South Atlantic area from North Carolina to Key West, Florida:

| Listed Species | Scientific Name | Status | Date Listed |
|---|---|---|---|
| Marine Mammals | | | |
| Blue whale | *Balaenoptera musculus* | E | 12/02/70 |
| Finback whale | *Balaenoptera physalus* | E | 12/02/70 |
| Humpback whale | *Megaptera novaeangliae* | E | 12/02/70 |
| Right whale | *Eubaleana glacialis* | E | 12/02/70 |
| Sei whale | *Balaenoptera borealis* | E | 12/02/70 |
| Sperm whale | *Physeter macrocephalus* | E | 12/02/70 |
| Turtles | | | |
| Green sea turtle | *Chelonia mydas* | T* | 07/28/78 |
| Hawksbill sea turtle | *Eretmochelys imbricata* | E | 06/02/70 |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | E | 12/02/70 |
| Leatherback sea turtle | *Dermochelys coriacea* | E | 06/02/70 |
| Loggerhead sea turtle | *Caretta caretta* | T | 07/28/78 |

| | | | |
|---|---|---|---|
| Fish | | | |
| Shortnose sturgeon | *Acipenser brevirostrum* | E | 03/11/67 |

Species proposed for listing: None
Designated Critical Habitat: None in the area of this project
Proposed Critical Habitat: None

| Candidate Species** | Scientific Name |
|---|---|
| Fish | |
| Dusky shark | *Carcharhinus obscurus* |
| Sand tiger shark | *Odontaspis taurus* |
| Night shark | *Carcharinus signatus* |
| Atlantic sturgeon | *Acipenser oxyrhynchus oxyrhynchus* |
| Speckled hind | *Epinephelus drummondhayi* |
| Warsaw grouper | *Epinephelus nigritus* |

*Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.
** Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

## 5.00 GENERAL EFFECTS ON LISTED SPECIES/CRITCAL HABITAT

Since all aspects of the proposed work will occur either in the estuary or on the ocean beach, the project will not affect any listed species occurring in forested or freshwater habitats. Thus, the bald eagle, red-cockaded woodpecker, wood stork, Canby's dropwort, Pondberry, and chaffseed will not be affected by the proposed action. In addition, since there is no coastal river associated with this project, the shortnose and Atlantic sturgeons will not be affected by this project

Species that could be present in the project area during the proposed action are the blue (NMFS list), finback, humpback, right, sei, and sperm whales. Also, the hawksbill (NMFS list), Kemp's ridley, leatherback, loggerhead, and green sea turtles could occur in the project area. However, loggerheads are the primary sea turtle nesters. The Florida manatee rarely visits the area but some sightings have been recorded over the years. Existing populations of seabeach amaranth occur on the sand spit on GCB and at a few areas between dunes on HBSP. The piping plover is an occasional visitor and winters in the area. The area of proposed critical habitat for the piping plover encompasses the southern end of GCB, almost all of the areas proposed for dredging, and both disposal areas on HBSP.

## 6.00 SPECIES ASSESSMENTS

### 6.01 Blue (NMFS list), finback, humpback, right, sei, and sperm whales

The blue whale may be the largest mammal ever to inhabit the earth. It may have reached lengths of up to 100 feet - roughly the length of a basketball court. Blue whales have weighed up to 160

tons. They feed on small shrimp-like crustaceans. The whales consume up to eight tons of these animals a day during their feeding period. A blue whale produced the loudest sound ever recorded from an animal, and some scientists have speculated that they may be able to remain in touch with each other over hundreds of miles. The number of blue whales in the southern hemisphere was severely depleted by whaling. Due to commercial whaling the size of the population is less than ten percent of what it was originally.

The finback whale is the second largest whale reaching lengths of up to 88 feet and weighs up to 76 tons. The finback whale because of its crescent-shaped dorsal fin, and obvious characteristic, is easily seen at sea. Depending on where they live, finback whales eat both fish and small pelagic crustaceans, and squids. It sometimes leaps clear of the water surface, yet it is also a deeper diver than some of the other baleen whales. The finback's range is in the Atlantic from the Arctic Circle to the Greater Antilles, including the Gulf of Mexico. In the Pacific Ocean the Finback ranges from the Bering Sea to Cape San Lucas, Baja California.

The humpback whale reaches a maximum length of about 51' long and a maximum weight of about 37.5 tons. They are mostly black, but the belly is sometimes white. Flippers and undersides of fluke are nearly all white. They are migratory. They eat krill and schooling fish. In the Atlantic they migrate from Northern Iceland and Western Greenland south to the West Indies, including the Northern and Eastern Gulf of Mexico. In the Pacific Ocean they migrate from the Bering Sea to Southern Mexico. The humpback is one of the most popular whales for whale watching on both the east and west coasts. Scientists estimate that there are 10,000 humpbacks worldwide, only about 8% of its estimated initial population.

The sei whale is one of the largest whales. It can reach a length of 60 feet and a weight of 32 tons. They feed primarily on krill and other small crustaceans, but also feed at times on small fish. The sei whale is the fastest of the baleen whales and can reach speeds of more than 20 miles per hour. In the Atlantic Ocean the Sei whale ranges from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the Sei whale may range from the Bering Sea to Southern Mexico. The Sei whale is endangered due to past commercial whaling.

Unlike the other great whales on the endangered species list, the sperm whale is a toothed whale. It is the largest of the toothed whales reaching a length of 60 feet in males and 40 feet in females. Sperm whales are noted for their dives that can last up to an hour and a half and go as deep as 2 miles under the surface. It is the most abundant of all the endangered whales, with an estimated population of two million. Sperm whales feed mainly on squid, including the giant squid. They range in the Atlantic Ocean from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the sperm whale ranges from the Bering Sea to Southern Mexico. The sperm whale was almost hunted to extinction for its oil (spermaceti). This oil was used in the manufacture of ointments, cosmetics, and candles. The sperm whales usually inhabit the offshore waters.

The right whale is the most endangered species of whale off of the U.S. coasts. The right whale got its name because it was the "right" whale to hunt. It was slow moving and floated after being killed. Current estimates indicate that presently no more than a few hundred exist. Right whales can reach a length of 60 feet and a weight of 100 tons. Although the species has been internationally protected since 1937, it has failed to show any signs of recovery.

Right whales have been observed along the eastern coast of North America from the Florida Keys north to the Gulf of St. Lawrence in Canada. They are found in relatively large numbers around Massachusetts and near Georges Bank in the spring, and then they migrate to two areas in Canadian waters by mid-summer. Most cows that give birth in any given year travel in the winter to the coastal waters of Georgia and Florida to calve and raise their young for the first three months. The Bay of

Fundy, between Maine and Nova Scotia, appears to serve as the primary summer and fall nursery hosting mothers and their first-year calves. The calf will stay with its mother through the first year and it is believed that weaning occurs sometime in the fall. Calves become sexually mature in about 8 years. Females are believed to calve about every three to four years. Sightings of right whales and their occurrence in the inshore waters of the State, although very rare, are generally assumed to represent individuals seen during this migration.

Right whales feed primarily on copepods and euphausids. They swim very close to the shoreline, often noted only a few hundred meters offshore. Because of their habit of traveling near the coast, there is concern over impacts resulting from collisions with boats and ships. Some right whales have been observed to bear propeller scars on their backs resulting from collisions with boats (NMFS, 1984). Destruction or pollution of right whale habitat is not known to be a problem in the project area. There is no designation of critical habitat for whales in SC.

**Effect Determination**

Of these six species of whales being considered, only the right whale would normally be expected to occur within the project area during the construction period; therefore the other species of whales are not likely to be affected. The majority of right whale sightings occur from December through February. Since the proposed work will not occur during this time period, these species are not expected to be within the project area during construction. Since all the disposal areas have previously received dredged material the project will simply maintain existing nearshore habitat conditions and food supplies already available to the right whale. The presence of an essentially stationary hydraulic cutterhead pipeline dredge in this area should pose no direct impacts to the right whale. In addition, Corps contract specifications expressly require avoidance of right whales. For these reasons, it has been determined that the project as proposed is not likely to adversely affect the right whale.

**6.02 Manatee**

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two axillary mammae, one at the base of each forelimb. Their bones are massive and heavy with no marrow cavities in the ribs or long bones of the forearms (Odell 1982). Adults average about 11.5 feet in length and 2,200 pounds in weight, but may reach lengths of up to 15 feet (Gunter 1941) and weigh as much as 3,570 pounds (Rathburn et al. 1990). Newborns average 4 to 4.5 feet in length and about 66 pounds (Odell 1981).

The West Indian manatee (*Trichechus manatus*) was listed as endangered on March 11, 1967, under a law that preceded the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.). Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972, as amended (16 USC 1461 et seq.) The manatee population in the United States is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia (USFWS, 1996). However, during the summer months, they may migrate as far north as coastal Virginia on the East Coast and Louisiana on the Gulf of Mexico (USFWS, 1991). The manatee is an uncommon summer resident of the South Carolina coast with some visual reports. Recorded sightings (personal communication w/John Coker/SCDNR) of the manatee in the Murrells Inlet area are listed as follows; 2 sightings in 1993 (July

& August), 1 sighting in July 1996, 5 sightings in July 1998, and 1 sighting in June 2000. There is no designation of critical habitat for the West Indian manatee in SC.

**Effect Determination**

The proposed work is currently scheduled to occur during the time of year when manatees may be visiting the area. For the protection of manatees, all Federal and contract personnel associated with this project shall be instructed on the potential presence of manatees and the need to avoid vessel or plant collisions with manatees. Since the proposed work is to be performed with a pipeline dredge, a dredge plant that is essentially stationary, no direct impacts to the manatee are anticipated. For these reasons, it has been determined that the proposed project is not likely to adversely affect the manatee.

**6.03 Kemp's ridley, leatherback, loggerhead, green, and hawksbill sea turtles**

There are five species of sea turtles on the Atlantic Coast, Kemp's ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas)*, and the Hawksbill sea turtle (*Eretmochelys imbricata*). These five species of sea turtles are protected by the Convention on International Trade in Endangered Species (CITES). They are also listed as endangered or vulnerable in the Red Data Book by the International Union for the Conservation of Nature (IUCN). The hawksbill, Kemp's ridley and leatherback were listed as endangered by the U. S. Endangered Species Act in 1973. The green turtle and the loggerhead were added to the list as threatened in 1978. All species that appear on the United States list are also on the South Carolina list.

Sea turtles vary in size from an average of 75 pounds for the olive ridley (does not occur in the project area) to the giant leatherback, which may exceed 800 pounds. Modified for living in the open ocean, they have paddle-like front limbs for swimming. The thick neck and head cannot be drawn back into the body. Sea turtles also have special respiratory mechanisms and organs to excrete excess salt taken in with seawater when they feed.

The leatherback is very different from the six other sea turtle species. Instead of plates (scutes) on the shell, the leatherback's carapace has seven hard longitudinal ridges along the length of the back. Its rubber-like covering is black with white spots and a pinkish-white underside. The average length of its shell is 5 feet. The green turtle is the second largest sea turtle and the loggerhead the third. Green turtles get their name from the color of their fat, not their shells, which are grayish in older animals. The smallest sea turtle is the Kemp's ridley; it has a drab olive to grayish-black shell. Loggerheads have rich reddish-brown shells and yellow on their undersides. The loggerhead's large skull provides for the attachment of strong jaw muscles for crushing conchs and crabs. The hawskbill has a patterned shell of brown and yellow with scutes that overlap like shingles on a roof. Its long, narrow head and beak enable it to feed among coral reefs.

Sea turtles occupy different habitats, depending upon their species, sex and age (size). Hatchlings and smaller juvenile loggerheads appear to live in floating mats of Sargassum in the open ocean. This seaweed offers cover, protection from predators and a source of food. Larger juveniles are generally seen in the same coastal habitat as the adults, especially during the summer.

Leatherbacks feed entirely on jellyfish, and they must often travel long distances to keep up with large concentrations of this food source drifting in the ocean currents. Green turtles are herbivorous and remain near pastures of turtle-preferred grasses. Often these pastures are not near their nesting beaches,

so these turtles migrate hundreds of miles to nest. Loggerheads usually leave the cold, coastal waters in the winter and are often seen along the edge of the Gulf Stream. Hawksbills live on coral reefs almost year-round, feeding on sponges, sea squirts and other bottom organisms. Although the Kemp's ridley nests only on Mexico's Gulf Coast, small juveniles of this species and the green turtle occur along the South Carolina coast during the summer.

Very little is known about male sea turtles since they almost never come ashore. Male loggerheads are seen in near-shore waters during the spring and early summer breeding season but apparently move back offshore once breeding is completed. Since the reproductive cycles of all sea turtles are similar, a generalized version encompasses all. Mating takes place offshore, and the turtles must only mate once to fertilize all eggs laid during the nesting season. When nesting, the female crawls onto the beach, usually at night, and digs a hole in the sand with her hind flippers. After laying about 100 (number of eggs vary among species) white, leathery eggs, she covers them and returns to the sea. A single female may nest several times a season, usually at 2-week intervals. The eggs incubate about 60 days, depending on the weather. Hatchlings dig out of the sand at night and make their way to the sea using light cues for guidance. Destruction of nests and hatchling mortality at sea are usually high. It appears sea turtles' high number of eggs per clutch and several nestings per season have evolved to offset this high mortality rate. Nesting habits of the Kemp's ridley deviate from those of other sea turtles. The Kemp's ridley is the only species that nests during the day. Most sea turtles do not nest every year. They return on either a 2- or 3-year cycle to the same general area or beach. Of these six species, only the loggerhead is considered to be a regular nester in SC. However, on September 9, 1996, a green sea turtle laid 135 eggs on GCB and a leatherback nest was recorded on HBSP in 2000. There is no critical habitat designation for sea turtles in SC. For purposes of this assessment, the loggerhead is considered to be the only species likely to nest in the project area.

**Loggerhead Sea Turtle.** The loggerhead sea turtle has a worldwide distribution and is found in temperate and subtropical waters. Major nesting areas in North America occur along the Southeast Coast from North Carolina to Florida. Loggerhead sea turtles regularly nest along the southern coast of South Carolina from Georgetown south, usually from mid-May to August. Nesting is preferred on remote beaches-and away from human disturbance. The loggerhead is considered a turtle of shallow water with juveniles preferring bays and estuaries. An omnivore, crustaceans, molluscs, squid, jellyfish, fish, and plant materials are desirable foods. Stranding data reveals that up to 70% of all stranded sea turtles are loggerheads with the majority of strandings occurring from May to August. Therefore, it can be surmised that the potential presence of loggerheads in the project area would most-likely occur at this time. In Georgia, South Carolina and North Carolina the nesting season generally begins in mid-May and ends by mid-August. Nesting activity is greatest, however, in June and July. Loggerheads are known to nest from one to seven times within a nesting season; the mean is approximately 4.1. The internesting interval varies around a mean of about 14 days. There is general agreement that females mate prior to the nesting season (and possibly only once) and then lay multiple clutches of fertile eggs throughout some portion of the nesting season. Mean clutch size varies from about 100 to 126 along the southeastern United States coast. Loggerheads are nocturnal nesters, but exceptions to the rule do occur infrequently. Multi-annual remigration intervals of two and three years are most common in loggerheads, but the number can vary from one to six years. The length of the incubation period is related to nest temperature. Sex determination in loggerhead hatchlings is temperature dependent and the species apparently lacks sex chromosomes. Natural hatching success rates of 73.4 percent and 55.7 percent have been reported in South Carolina. Loggerhead hatchlings engage in a "swimming frenzy" for about 20 hours after they enter the sea and that frenzy takes them about 22 to 28 kilometers offshore.

At some point thereafter they become associated with Sargassum rafts and/or debris at current gyres. Upon reaching about 45 cm mean straight carapace length (sCL), their abandon the pelagic existence and migrate to near-shore and estuarine waters of the eastern United States, the Gulf of Mexico and the Bahamas and begin the subadult stage. As adults, loggerheads become migratory for the purpose of breeding. Reported tag recoveries suggest a "migratory path" from Georgia to Cape Hatteras, North Carolina with a single recovery of a Georgia tagged female on the Florida Gulf Coast (Tampa Bay). Little else is known of the scheduled travels of Georgia, South Carolina, and North Carolina nesters outside of the nesting season (NMFS, USFWS, 1991).

**Affected sea turtle environment.** The areas of affected environment for this proposed project are the marine areas proposed for O&M dredging (see Figure 1) and the disposal areas on GCB and the intertidal zone on HBSP (see Figures 3 and 4).

The approximate area square feet (sf) of the areas proposed for O&M dredging are as follows:

- Deposition Basin - (650,100 sf)
- Inner Channel B - (76,900 sf)
- Inner Channel A - (388,100 sf)
- Auxiliary Channel - (160,800 sf)
- Entrance Channel - (423,000 sf).

The amount of O&M dredged material (sand) proposed for disposal on GCB is approximately 330,000 cubic yards (cy). It will be placed parallel to the existing shoreline for a distance of approximately 4,600 feet with a width of approximately 200 feet. The total area encompasses approximately 30 acres. Only a portion of this total area between the toe of the dune and MHW may be considered suitable sea turtle nesting habitat. The other disposal location is in the intertidal zone on the beach at HBSP. The beach compatible material (sand) proposed for disposal in the intertidal zone on HBSP will vary from approximately 140,000 cy to approximately 280,000 cy depending on the quantity of material available. It will be placed parallel to the existing shoreline in the intertidal zone for a distance that may vary from approximately 1,800 feet to approximately 3,600 feet with a width of approximately 250 feet wide @ mean high water (MHW).

**Current rangewide conditions for sea turtles.** It is not possible, at present, to estimate the size of the loggerhead population in United States territorial waters if one includes subadults. There is, however, general agreement that enumeration of nesting females provides a useful index to population size and stability. It is estimated that 14,150 females nest per year in the southeastern United States. This estimate was based on aerial survey data from 1983 has been accepted as the best current approximation. Given a stochastically derived mean number of nests per female (4.1), this figure provides an estimate of approximately 58,000 nests deposited per year in the Southeast. Based on more extensive ground and aerial surveys throughout the Southeast in recent years (1987 to 1990), it is estimated that approximately 50,000-70,000 nests are deposited annually. These totals constitute about 35 to 40 percent of the loggerhead nesting known worldwide and clearly rank the southeastern United States aggregation as the second largest in the world, with the somewhat larger Oman assemblage being the only other truly large group remaining anywhere (NMFS, USFWS, 1991).

A recent review considered consequences of life tables and population models; mortality rates in the Southeast; population declines in South Carolina and Georgia; and estimates of annual mean clutch production per female. It was concluded that the stock of loggerheads represented by females that nest in the Southeast is continuing to decline (NMFS, USFWS, 1991).

**Conditions for sea turtles in the project area.** South Carolina United Turtle Enthusiasts (SCUTE) monitor approximately 78 km of beach in northern Georgetown and Horry Counties that includes GCB. GCB consists of high-rise condominiums and homes on the dune field with little suitable nesting habitat or relocation sites. The occasional nest laid at GCB is relocated to HBSP to improve hatching success. Due to the low nesting, GCB is not patrolled daily. SCUTE relies on calls from the public to report nests. There were no nests on GCB in 1992, 1993, or 1996. From 1991 to 1997, GCB had averaged 2 or fewer nests each year. In 1998, 5 nests were recorded and in 1999, 2 nests were recorded. 2 false crawls were recorded in 2000.

The following Marine Turtle Nesting Summary (1993 – 2000) and other sea turtle data was provided by Steven D. Roff (SCPRT), Interpretive Ranger at HBSP. The following is a brief synopsis of sea turtle nesting at HBSP. All data represents the efforts of loggerhead sea turtles (*Caretta caretta*) with the exception of one leatherback (*Dermochelys coriacea*) nest recorded in 2000. Please see Appendix B for a chart showing the HBSP sea turtle data. All surveys were conducted daily beginning on May 15th through mid October of each year. Nesting success evaluations were conducted either 75 days after nests were deposited or 3 days after the first emergence, whichever first occurred. SCPRT's goals for conserving sea turtles include:

- Protection and documentation of all marine turtle nesting attempts.
- Data collection on individual nest as stipulated by South Carolina Department of Natural Resources.
- Public education through active interpretation and passive interpretive displays.
- Public volunteer training and coordination through partnerships with the South Carolina United Turtle Enthusiast Volunteer Network and the South Carolina Department of Natural Resources.
- Conduct all park related activities in accordance with the most recent edition of the South Carolina Department of Natural Resource's Guidelines for Marine Turtle Permit Holders, Nest Protection and Management.
- Provide quality habitat for marine turtle nesting and optimal hatchling production.

During the eight year period (1993-2000) a total of 108 nests were laid on the three miles of beach at HBSP, averaging just a little over 13 nest per year, of which 46 nests were predated prior to nest location and screening (see Appendix B). Total egg production was 10,562 resulting in 9,711 hatchling sea turtles (see Table 1 below). Overall hatching success for the sampling period was 85.1% (see Appendix B).

Table 1.
Totals for 1993-2000 Marine Turtle Nesting on HBSP

| Hatchlings | Eggs | Nests | Hatching % |
|---|---|---|---|
| 9,711 | 10,562 | 108 | 85.1 |

## SCPRT's Future Management Considerations

(Info provided by Steven D. Roff (SCPRT)

No other fact contributed to egg mortality more than nest predation prior to screening and locating the nest. The number of predated nests during the sampling period ranged from zero (1998) to

thirteen (1996). The primary and only documented predator was the red fox (*Vulpes fulva*). These foxes were observed to patrol the primary dune line at night and digging up nests after they were buried in the dune. Since the PRT patrols began at first light a predated turtle nest may lay open to the elements for over 8 hours. These nests would only have 20 – 30 eggs remaining after predation. These remaining eggs were cleaned and then relocated. These small nests normally exhibit very low hatching success. If yearly fox predation causes mortality on more than 25% of the nests laid, PRT expects to give serious attention to the management of this naturalized non-native species. SCPRT has a current Marine Turtle Management Plan for HBSP (see Appendix A).

**Cumulative effects of actions in project area on sea turtles.** Very little is known about sea turtle diseases or natural mortality, rates. However, it is believed that declines in populations are a direct result of human actions. Erosion of nesting beaches can result in partial or total loss of suitable nesting habitat. Dynamic coastal processes, including sea level rise, influence erosion rates. Man's interference with these natural processes through coastal development and associated activities has resulted in accelerated erosion rates and interruption of natural shoreline migration. Where beachfront development occurs like at GCB, the site is often fortified to protect the property from erosion. Virtually all shoreline engineering is carried out to save structures, not dry sandy beaches, and ultimately, this results in environmental damage. One type of shoreline engineering, collectively referred to as beach armoring, includes sea walls, rock revetments, riprap, sandbag installations, groins and jetties. Beach armoring can result in permanent loss of a dry nesting beach through accelerated erosion and prevention of natural beach/dune accretion and can prevent or hamper nesting females from accessing suitable nesting sites. Clutches deposited seaward of these structures may be inundated at high tide or washed out entirely by increased wave action near the base of these structures. As these structures fail and break apart they spread debris on the beach that may further impede access to suitable nesting sites (resulting in higher incidences of false crawls) and trap hatchlings and nesting turtles. Sandbags are particularly susceptible to rapid failure and result in extensive debris on nesting beaches. Rock revetments, riprap and sand bags can cause nesting turtles to abandon nesting attempts or to construct improperly, sized and shaped egg cavities when inadequate amounts of sand cover these structures. Approximately 21 percent (234 km) of Florida's, 10 percent (18 km) of Georgia's and 10 percent (30 km;) of South Carolina's beaches are armored (NMFS, USFWS, 1991).

Groins and jetties are designed to trap sand during transport in longshore currents or to keep sand from flowing into channels in the case of the latter. These structures prevent normal sand transport and accrete beaches on one side of the structure while starving neighboring beaches on the other side thereby resulting in severe beach erosion and corresponding degradation of suitable nesting habitat. Beach nourishment consists of pumping, trucking or scraping sand onto the beach to rebuild what has been lost to erosion. Beach nourishment can impact turtles through direct burial of nests and by disturbance to nesting turtles if conducted during the nesting season. Sand sources may be dissimilar from native beach sediments and can affect nest site selection, digging behavior, incubation temperature (and hence sex ratios), gas exchange parameters within incubating nests, hydric environment of the nest, hatching success and hatchling emergence success. Beach nourishment can result in severe compaction or concretion of the beach. Trucking of sand onto project beaches may increase the level of compaction (NMFS, USFWS, 1991).

Significant reductions in nesting success have been documented on severely compacted nourished beaches. Compaction levels that have been evaluated at ten renourished east coast Florida beaches concluded that 50 percent were hard enough to inhibit nest digging, 30 percent were questionable as to whether their hardness affected nest digging and 20 percent were probably not hard

enough to affect nest digging. They further concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and, while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more. Nourished beaches often result in severe escarpments along the mid-beach and can hamper or prevent access to nesting sites. Nourishment projects result in heavy machinery, pipelines, increased human activity and artificial lighting on the project beach. These activities are normally conducted on a 24-hour basis and can adversely affect nesting and hatching activities. Pipelines and heavy machinery can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls (non-nesting emergences). Increased human activity on the project beach at night may cause further disturbance to nesting females. Artificial lights along the project beach and in the nearshore area of the borrow site may deter nesting females and disorient or misorient emergent hatchlings from adjacent non-project beaches (NMFS, USFWS, 1991).

Beach nourishment projects require continual maintenance (subsequent nourishment) as beaches erode and hence their negative impacts to turtles are repeated on a regular basis. Beach nourishment projects conducted during the nesting season can result in the loss of some nests which may be inadvertently missed or misidentified as false crawls during daily patrols conducted to identify and relocate nests deposited on the project beach. Nourishment of highly eroded beaches (especially those with a complete absence of dry beach) can be beneficial to nesting turtles if conducted properly. Careful consideration and advance planning and coordination must be carried out to ensure timing, methodology and sand sources are compatible with nesting and hatching requirements (NMFS, USFWS, 1991).

Extensive research has demonstrated that the principal component of the sea finding behavior of emergent hatchlings is a visual response to light. Artificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles and other types of beachfront lights has been documented in the disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchling turtles. The results of disorientation or misorientation are often fatal. As hatchlings head toward lights or meander along the beach their exposure to predators and likelihood of desiccation is greatly increased. Misoriented hatchlings can become entrapped in vegetation or debris, and many hatchlings are found dead on nearby roadways and in parking lots after being struck by vehicles. Hatchlings that successfully find the water may be misoriented after entering the surf zone or while in nearshore waters. Intense artificial lighting can even draw hatchlings back out of the surf (NMFS, USFWS, 1991).

The problem of artificial beachfront lighting is not restricted to hatchlings. It has been indicated that adult loggerhead emergence patterns were correlated with variations in beachfront lighting in south Brevard County, Florida, and that nesting females avoided areas where beachfront lights were the most intense. It has also been noted that loggerheads aborted nesting attempts at a greater frequency in lighted areas. Problem lights may not be restricted to those placed directly on or in close proximity to nesting beaches. The background glow associated with intensive inland lighting, such as that emanating from nearby large metropolitan areas, may deter nesting females and disorient or misorient hatchlings navigating the nearshore waters. Cumulatively, along the heavily developed beaches of the southeastern United States, the negative effects of artificial lights are profound (NMFS, USFWS, 1991).

Residential and tourist use of developed (and developing) nesting beaches can result in negative impacts to nesting turtles, incubating egg clutches and hatchlings. The most serious threat caused by increased human presence on the beach is the disturbance to nesting females. Night-time human activity can cause nesting females to abort nesting attempts at all stages of the behavioral process. It has been reported that disturbance can cause turtles to shift their nesting beaches, delay egg laying, and select poor nesting sites. Heavy utilization of nesting beaches by humans (pedestrian traffic) may result in lowered hatchling emergence success rates due to compaction of sand above nests and pedestrian tracks

can interfere with the ability of hatchlings to reach the ocean. Campfires and the use of flashlights on nesting beaches misorient hatchlings and can deter nesting females (NMFS, USFWS, 1991).

A variety of natural and introduced predators such as raccoons, foxes, ghost crabs and ants prey on incubating eggs and hatchling sea turtles. The principal predator is the raccoon (*Procyon lotor).* Raccoons are particularly destructive and may take up to 96 percent of all nests deposited on a beach. In addition to the destruction of eggs, certain predators may take considerable numbers of hatchlings just prior to or upon emergence from the sand (NMFS, USFWS, 1991).

Nest loss due to erosion or inundation and accretion of sand above incubating nests appear to be the principal abiotic factors that may negatively affect incubating egg clutches. While these factors are often widely perceived as contributing significantly to nest mortality or lowered hatching success, few quantitative studies have been conducted. Studies on a relatively undisturbed nesting beach indicated that excepting a late season severe storm event, erosion and inundation played a relatively minor role in destruction of incubating nests. Inundation of nests and accretion of sand above incubating nests as a result of the late season storm played a major role in destroying nests from which hatchlings had not yet emerged. Severe storm events (e.g., tropical storms and hurricanes) may result in significant nest loss, but these events are typically aperiodic rather than annual occurrences. In the southeastern United States, severe storm events are generally experienced after the peak of the hatching season and hence would not be expected to affect the majority of incubating nests. Erosion and inundation of nests are exacerbated through coastal development and shoreline engineering. These threats are discussed above under beach armoring (NMFS, USFWS, 1991).

The effects of dredging are evidenced through on or degradation of habitat and incidental take of marine turtles. Channelization of inshore and nearshore habitat and the disposal of dredged material in the marine environment can destroy or disrupt resting or foraging grounds (including grass beds and coral reefs) and may affect nesting distribution through the alteration of physical features in the marine environment. Hopper dredges are responsible for incidental take and mortality of marine turtles during dredging operations. Other types of dredges (clamshell and pipeline) have not been implicated in incidental take (NMFS, USFWS, 1991).

Of all commercial and recreational fisheries conducted in the United States, shrimp trawling is the most damaging to the recovery of marine turtles. The estimated number of loggerheads killed annually by the offshore shrimping fleet in the southeastern United States Atlantic and Gulf of Mexico is 5,000 to 50,000. Incidental capture and drowning in shrimp trawls is believed to be the largest single source of mortality on juvenile through adult stage marine turtles in the southeastern United States. Most of these turtles are juveniles and subadults, the age and size classes most critical to the stability and recovery of marine turtle populations. Quantitative estimates of turtle take by shrimp trawlers in inshore waters have not been developed, but the level of trawling effort expended in inshore waters along with increasing documentation of the utilization of inshore habitat by loggerhead turtles suggest that capture and mortality may be significant. Trawlers targeting species other than shrimp tend to use larger nets than shrimp trawlers and probably also take sea turtles, although capture levels have not been developed. These fisheries include, but are not limited to bluefish, croaker, flounder, calico scallops, blue crab and whelk. Of these, the bluefish, croaker and flounder trawl fisheries likely pose the most serious threats. The harvest of Sargassum by trawlers can result in incidental capture of post hatchlings and habitat destruction (NMFS, USFWS, 1991).

**Effect Determination**

Loggerhead sea turtle nesting activities have been recorded within the project area on GCB and HBSP. The placement of sand and construction activities associated with the placement of that sand on these beaches could adversely affect any existing sea turtle nests and sea turtles attempting to nest. The extent of nesting on Garden City beach is considered to be minor and irregular when compared with other beaches along the coast. HBSP averages approximately 4 nests per kilometer. The construction work will extend into the nesting season. Therefore, a standardized nest monitoring and relocation plan will be implemented. The plan incorporates monitoring of the beach disposal areas each morning from the beginning of the nesting season until all equipment is removed from the beach and the relocation of any nests located within the project area. Using standard nest relocation techniques, all nests will be relocated to a suitable nursery beach (probably HBSP), agreed to prior to the relocation effort by the USFWS and SCDNR. Hatching success of relocated nests will be monitored and reported. By following these methods, the possibility of a sea turtle nest being inadvertently buried by beach disposal will be minimized. All nest monitoring and relocation on HBSP will be accomplished by SCPRT. A contractor hired by the Corps will perform all nest monitoring and arrange for relocation from Garden City Beach.

In addition to the above mentioned conservation measures, the Corps has developed a standard beach monitoring protocol to measure beach hardness/compaction after placement of disposal material on the beach. After the material is disposed of on the beach, any areas that are determined to have an in situ hardness greater than 500 Cone Penetrometer Units (CPU) is tilled in order to make it suitable for sea turtle nesting. All of the dredging for the proposed project will be accomplished with a hydraulic pipeline cutterhead dredge in the specified areas.

Visual surveys for escarpments along the Project area will be made during construction and immediately after completion of the O&M Project and prior to May 1 for 3 subsequent years. Results of the surveys will be submitted to the USFWS prior to any action being taken. Since the Project will occur during the sea turtle nesting season it may be determined to level escarpments immediately. The USFWS will be contacted immediately if subsequent reformation of escarpments exceeding 18 inches in height for a distance of 100 feet occurs during nesting and hatching season. This coordination will determine what appropriate action must be taken. An annual summary of escarpment surveys and action taken will be submitted to the USFWS.

By monitoring beach hardness and assuring that it is suitable for sea turtle nesting, the project should maintain the suitability of the project area beaches for sea turtle nesting. The monitoring and relocation program will minimize potential adverse effects to nesting sea turtles. Completion of the project will recreate lost habitat and protect existing turtle nesting habitat. However, because of the possibility of missing a sea turtle nest during the nest monitoring program or inadvertently breaking eggs during relocation, it has been determined that the project may adversely affect the loggerhead sea turtle.

**6.03 Shortnose sturgeon**

The Shortnose Sturgeon occurs in Atlantic seaboard rivers from southern New Brunswick to northeastern Florida. Department of Commerce studies have shown that the shortnose sturgeon exists in many of the large coastal river systems in South Carolina. Little is known about the shortnose sturgeon population level, life history or ecology. Their status is probably due to exploitation, damming of rivers

and deterioration of water quality. Because there is no coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the sturgeon in the immediate project area.

**Effect Determination**

It is unlikely that the shortnose sturgeon occurs in the project area, however, should it occur, its habitat would be only minimally altered by the proposed project. Any shortnose sturgeons in the area should be able to avoid being taken by a slow moving pipeline dredge. For these reasons, it has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.

**6.04 Piping plover and proposed piping plover critical habitat**

Piping plovers are small shorebirds approximately six inches long with sand-colored plumage on their backs and crown and white under parts. Breeding birds have a single black breast band, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During the winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black.

The piping plover breeds on the northern Great Plains, in the Great Lakes, and along the Atlantic coast (Newfoundland to North Carolina); and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico, and in the Bahamas West Indies.

Piping plovers nest along the sandy beaches of the Atlantic Coast from Newfoundland to North Carolina, the gravelly shorelines of the Great Lakes, and on river sandbars and alkali wetlands throughout the Great Plains region. They prefer to nest in sparsely vegetated areas that are slightly raised in elevation (like a beach berm). Piping plover breeding territories generally include a feeding area, such as a dune pond or slough, or near the lakeshore or ocean edge. The piping plover winters along the coast, preferring areas with expansive sand or mudflats (feeding) in close proximity to a sandy beach (roosting). The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (USFWS, 1996a).

The piping plover is an occasional visitor along the South Carolina coast during the winter months and individuals are occasionally sighted in the project area. However, there are no large wintering concentrations in the state. Piping plovers are considered threatened species under the Endangered Species Act of 1973, as amended, when on their wintering grounds. The species is not known to nest in the project area. GCB is unsuited for the species due to the heavy development along the ocean beach and heavy recreational use. The ocean beachfront on HBSP is undeveloped and has less recreational use than GCB.

The USFWS is proposing to designate 15 areas along the South Carolina (SC) coast as critical habitat for the wintering populations of the piping plover. This includes approximately 138 miles of shoreline along the SC coast along margins of interior bays, inlets, and lagoons. Using the coordinates identified in the Federal Register, the Corps prepared a map (see Figure 5) showing the boundaries of the proposed piping plover critical habitat in the project area.

**Effect Determination**

Disposal of the dredged material is currently scheduled to occur during the months of June-September. Direct loss of nests from the disposal of the dredged material will not occur, as the species

is not known to nest in the project area. Piping plover foraging distribution on the beach during the winter months may be altered as beach food resources may be affected by disposal of material and the dredging of the sand spit at the southern tip of GCB. Such disruptions will be temporary and of minor significance. The shorebird habitat area originally constructed at the west (landward) end of the south jetty on HBSP has suffered severe erosion. Dredged material will be used to restore the habitat lost to erosion in this area. This shorebird habitat will be fenced in, monitored, and managed by PRC. The disposal of dredged material into the intertidal zone on HBSP will provide additional foraging habitat for the wintering piping plover. For these reasons, it has been determined that the proposed project is not likely to adversely affect the piping plover. It has also been determined that the proposed project is not likely to adversely modify proposed critical habitat for wintering piping plovers.

### 6.05 Seabeach amaranth

Seabeach amaranth (*Amaranthus pumilus*) is an annual plant historically native to the barrier island beaches of the Atlantic coast from Massachusetts to South Carolina. No other vascular plant occurs closer to the ocean. The species was federally listed as threatened by the U.S. Fish and Wildlife Service in 1993 (USFWS, 1996b). Seabeach amaranth is listed as threatened and of national concern in South Carolina.

Germination takes place over a relatively long period of time, generally beginning in April and continuing at least through July. Upon germinating, this plant initially forms a small-unbranched sprig but soon begins to branch profusely into a clump, often reaching a foot in diameter and consisting of 5 to 20 branches. Occasionally a clump may get as large as a yard of more across, with hundreds or more branches. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 1.3 to 2.5 centimeters in diameter. The leaves are clustered toward the tip of the stem, are normally a somewhat shiny, spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous and are borne in clusters along the stems. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June in the Carolinas but more typically commencing in July and continuing until their death in late fall or early winter. Seed production begins in July or August and reaches a peak in most years in September; it likewise continues until the plant dies (USFWS, 1996b).

Seabeach amaranth occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of noneroding beaches. It occasionally establishes small temporary populations in other habitats, including sound side beaches, blowouts in foredunes, and in dredged material placed for beach renourishment or disposal. Seabeach amaranth appears to be intolerant of competition and does not occur on well-vegetated sites. The species appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape as a fugitive species, occupying suitable habitat as it becomes available (USFWS, 1996b).

Seabeach amaranth is a "fugitive" species that cannot compete with dense perennial beach vegetation and only occurs in the newly-disturbed habitat of a high-energy beach. It occurs on barren or sparsely-vegetated sand above the high water line, an area classified as marine wetland. This habitat usually disappears completely when seawalls or other hard structures are built along the shoreline. This loss of habitat from seawall construction and global sea level rise are thought to be major factors in the species' extirpation throughout parts of its historic range. It has been postulated that estuarine and coastal shore plants will suffer some of the most significant impacts as a result of global climate changes. Coastal development will prevent these species from migrating up slope to slightly higher

ground if sea levels rise. To a large extent, this is already occurring as beaches are being fortified to prevent erosion. Beach renourishment projects eliminate existing plants if conducted during the summer and may bury the seed needed to reestablish the plant the following year if conducted during the winter. However, beach renourishment projects often rebuild the habitat this species requires. Fortification with seawalls and other stabilization structures or heavy vehicular traffic may eliminate seabeach amaranth populations locally. Any given site will become unsuitable at some time because of natural forces. However, if a seed source is no longer available in adjacent areas, seabeach amaranth will be unable to reestablish itself when the site is once again suitable or new favorable habitat is created. In this way, it can be progressively eliminated even from generally favorable stretches of habitat surrounded by permanently unfavorable areas (USFWS, 1996b).

Historically, seabeach amaranth occurred in 31 counties in 9 states from Massachusetts to South Carolina. It has been eliminated from six of the States in its historic range. The only remaining large populations are in North Carolina. Surveys in South Carolina found that the number of plants along our coast dropped by 90% (from 1,800 to 188) as a result of Hurricane Hugo, subsequent winter storms and beach rebuilding projects that occurred in its wake. South Carolina populations are still very low and exhibit a further downward trend although 1998 was a better year than most with 279 plants identified along the coast. It is possible that the abundant rainfall associated with El Nino in the spring of 1998 produced a larger than normal population. The remaining populations in areas with suitable habitat are in constant danger of extirpation from hurricanes, webworm predation, and other natural and anthropogenic factors (USFWS, 1996b).

Seabeach amaranth habitat areas that will be affected occur in one area on GCB and numerous areas on HBSP. The GCB area is located on the southeastern edge of the sand spit at the end of GCB. This sand spit has migrated into the original constructed federal navigation channel (see Figure 1). According to SCDNR, the project area contains the largest natural population of seabeach amaranth plants and wild seed source on the coast of SC. Other naturally occurring populations exist on HBSP along with some seabeach amaranth restoration areas established by SCDNR and SCPRT. These are located in washovers at three locations between the existing dunes on the beach at HBSP southeast of the south jetty. Most of these locations are located within the boundaries of the HBSP beach disposal area established during original construction of the project.

SCDNR, SCPRT and the Corps have documented the history of seabeach amaranth populations on GCB and HBSP. It can be assumed that the species maintained populations on both sides of the inlet prior to man's structural intervention on the shore. The Corps had seabeach amaranth surveys performed on GCB/Murrells Inlet in August 1993, June/August 1994, and June 1995 during the Myrtle Beach and Vicinity Shore Protection Project. According to following data provided by Mr. Dickie Hamilton (SCDNR) population counts effectively began in 1987. The GCB plants are all wild plants. The HBSP plants were all wild in 1995, 1997, and 1998. All HBSP plants were cultured in 1999 and 2000 except for two in 2000 that emerged in the area where cultured plants were in 1999. All the plants at GCB and HBSP were counted between the end of August-September except for the 39 plants at GCB in 1998. Those were counted while Steve Roff and Mr. Hamilton collected clippings in June 1998. Most of those probably made it to seed-set in August, as 1998 was a wet year. Population surveys for seabeach amaranth are generally done in August-September when plants are seeding.

**Seabeach amaranth population counts for GCB and HBSP**
(No data available for 1989, 1991, 1992, and 1996)

| | 1987 | 1988 | 1990 | 1993 | 1994 | 1995 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Murrells Inlet/GCB | 615 | 166 | 14 | 537 | 110 | 148 | ? | 39 | 0 | 3 |
| HBSP | 426 | 1281 | 14 | ? | ? | 85 | 77 | 171 | 78 | 504 |

Based on the available recorded information, seabeach amaranth is known to occur in areas that will be directly or indirectly affected by the proposed project.

**Effect Determination**

The population of amaranthus on the southern tip of GCB will be adversely impacted by the proposed project, with the majority, if not all, of the suitable amaranthus habitat being removed. During the highest count year (1987), this would equate to a loss of habitat for over 615 plants; during the lowest count years (1999, 2000), the loss would have been less - habitat for roughly 0-3 plants.

In general, disposal of dredged material on a beach will result in alterations of beach profile and can bury either plants or seeds depending on the period when the work is performed. On the surface, the impacts of such actions on the species would appear to be clearly adverse; however, an examination of seabeach amaranth distribution by the Wilmington District Corps office indicates that the species thrives in many frequently used beach disposal sites in NC. This possibly occurs because the disturbance generated by disposal actions mimics the natural disturbances found in its preferred habitat. This may illustrate that habitat maintenance, rather than maintenance of individual plants, is of overriding importance to the species.

Since the proposed work is scheduled to take place in the July-September time frame, seabeach amaranth will probably be germinating and/or flowering in July and producing seeds in August. Therefore, if any plants still exist on GCB, flowering plants may be directly taken from the sand spit. Numerous conversations and coordination meetings have occurred with the USFWS, SCDNR, and SCPRT to determine what conservation measures can be implemented to minimize adverse impacts to seabeach amaranth plants, seed banks and habitat. Prior to beginning construction, a team compromised of the Corps, the USFWS, possibly the SCDNR, and the SCPRT will survey HBSP and GCB (including sand spit) for plants and the Corps will map (by GPS) all the existing seabeach amaranth habitat and restoration areas. If it is later agreed upon by the team, the seed bank area located on the sand spit on GCB may be scraped (by bulldozer) to a depth of 6"-12" and temporarily stockpiled until the dredging of Inner Channel A and the Deposition Basin is completed. After the remaining areas on the sand spit settle from the effects of the dredging the seed bank material previously scraped and stockpiled from the area could be redistributed on areas selected by the team during the amaranth survey and mapping effort. It is possible that the above described conservation effort is unable to be carried out due to property ownership complications and/or a lack of suitable habitat areas on the remaining area of the sand spit due to the effects of the dredging. Regardless of whatever conservation measures are carried out, a portion, if not all, of the in situ seed bank that supplies the sand spit on GCB will be removed and disposed of on HBSP. Since the disposal of the dredged material on beaches seems to maintain desirable habitat for the species, the seeds transported to HBSP may germinate and thrive in the newly deposited material. If this is the case, the proposed project will be beneficial to the long-term survival potential of the species in Murrells Inlet.

Even though a portion of the sand spit on GCB will be removed, it will most likely continue its accretion/migration into Murrells Inlet for the foreseeable future. As the sand spit accretes, habitat for amaranthus will again be created up until such time as maintenance dredging becomes necessary. This accreted area will likely be repopulated by seabeach amaranth seeds that either remain in the sand spit after the dredging is completed, wash in from material being placed on GCB north of the jetty or from the seed bank material scraped up and stockpiled prior to dredging. While the extent of the seed bank that remains is unknown, there is no reason to believe that it is not sufficient to repopulate the area between maintenance dredging events. The Corps will perform seabeach amaranth surveys on HBSP and GCB for 2001, 2002, and 2003 therefore; data regarding impacts will be available after these monitoring efforts are completed. Because known habitat for seabeach amaranth will be removed in one area and redistributed in other areas, we have determined that maintaining the project as proposed is likely to adversely affect seabeach amaranth.

## 7.0 SUMMARY OF PROTECTIVE MEASURES

Personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The standard manatee conditions apply annually from 1 June to 30 September. It is the responsibility of the Contractor to take necessary precautions to avoid any contact with manatees. If manatees are sighted within 100 yards of the dredging area, all appropriate precautions shall be implemented to insure protection of the manatee. The Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 50 feet of the manatee. Operation of equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment.

In order to minimize impacts to nesting sea turtles a beach monitoring (for hardness/escarpment formation) and nest relocation program for sea turtles will be implemented. This program will include daily patrols of disposal areas at sunrise, relocation of any nests laid in areas to be impacted by disposal of dredged material, and monitoring of hatching success of the relocated nests. Sea turtle nests will be relocated to an area suitable to both the USFWS and the SCDNR (probably on HBSP). The Corps will perform any necessary maintenance of beach profile (tilling and shaping or knocking down escarpments) during construction and prior to each nesting season.

During construction of this project, staging areas for construction equipment will be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all dredge pipes that are placed on the beach will be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes will be off the beach to the maximum extent possible. Temporary storage of pipes on the beach will be in such a manner so as to impact the least amount of nesting habitat and will likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline will be recommended as the method of storage).

During construction of this project, all on-beach lighting associated with the project will be limited to the immediate area of active construction only. Such lighting will be shielded, low-pressure

sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters will be placed over vehicle headlights (i.e., bulldozers, front end loaders). No offshore equipment will be required to construct this project as proposed. However, if required, lighting on offshore equipment will be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded, low pressure sodium vapor lights will be highly recommended for lights on any offshore equipment that cannot be eliminated. On HBSP, the O&M dredged material will be disposed of in the intertidal zone to minimize adverse impacts to nesting sea turtles and their habitat.

Intertidal disposal will also minimize adverse impacts to existing wild populations of seabeach amaranth as well as the restoration areas of seabeach amaranth located on HBSP. Other protective measures to be implemented for seabeach amaranth plants, seed bank, and habitat located on GCB will be determined prior to beginning project as described on Page 19.

## 8.0 SUMMARY EFFECT DETERMINATION

This assessment has examined the potential impacts of the proposed project on proposed critical habitat and listed species of plants and animals that are, or have been, present in the project area. Both primary and secondary impacts to habitat have been considered. Critical habitat has not been designated for whales, manatees, sea turtles, sturgeon, piping plover, or seabeach amaranth in South Carolina; therefore, none would be affected. The USFWS proposed to designate critical habitat for the wintering piping plover in July 2000. A final decision on designation of critical habitat for wintering piping plovers has not currently been published. Based on this analysis, the following determinations have been made.

- It has been determined that the proposed project is not likely to adversely affect the blue (NMFS list), finback, humpback, right, sei, or sperm whales.
- It has been determined that the proposed project is not likely to adversely affect the manatee.
- It has been determined that the proposed project is not likely to adversely affect Kemp's ridley, leatherback, green, or hawksbill sea turtles.
- It has been determined that the proposed project is not likely to adversely affect the shortnose sturgeon.
- It has been determined that the proposed project is not likely to adversely affect the piping plover.
- It has been determined that the proposed project is not likely to adversely modify proposed critical habitat for the wintering piping plover.
- It has been determined that the proposed project may affect- is likely to adversely affect the nesting loggerhead sea turtle and seabeach amaranth.

## 8.0 List of Contacts Made

Extensive verbal communication and coordination meetings have occurred and will continue to occur with USFWS, SCDNR, SCDHEC (OCRM), National Marine and Fisheries Service (NMFS) and SCPRT to adequately address environmental concerns until the O&M dredging and disposal Project is completed. The following list will identify some of the individuals contacted by the Corps for environmental coordination.

USFWS - Ms. Paula Sisson and Mr. Ed EuDaly
SCDNR - Mr. Richard (Dickie) Hamilton, Mr. Ed Duncan, Mr. David Whitaker, Mr. Rob Dunlap, Mrs. Sally Murphy, and Mr. Tom Murphy
SCDHEC (OCRM) - Mr. Bill Eiser
NMFS - Mr. Prescott Brownell and Mr. Eric Hawk
SCPRT - Mr. Steve Roff, Mr. Keith Windham, Mr. Ervin Pitts, Mr. David Simms, and Mr. Scott Langford
College of Charleston - Mr. Alan Strand
SCUTES - Mr. Jeff McClary

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# Appendix A

## SCPRT's Marine Turtle Management Plan

All marine turtles carry either endangered or threatened status sea turtles that have been reported to nest or strand within or in close proximity to the park include: the Loggerhead (*Caretta caretta*), Kemp Ridley (*Lepidochelys kempii*), Leatherback (*Dermochelys coriacea*) and Green (*Chelonia mydas*) sea turtles. In May of 2000, staff recorded and observed the first Leatherback nesting within the park boundary. This nest produced the first recorded Leatherback hatchlings to enter the Atlantic Ocean from a South Carolina beach.

The federally threatened loggerhead turtle is the only marine turtle that regularly nests on South Carolina beaches. Nesting attempts on the park are sporadic, with 20 or less occurring most years (see Marine Turtle Nesting Summary (1993 – 2000), Huntington Beach State Park). Adult loggerheads enter waters offshore to mate in April and will remain until October. From mid-May through August, females come ashore to lay eggs, usually near the base of the primary dune line. On average, 132 eggs are deposited. In some areas, turtle nests suffer heavily from egg predation mainly by raccoons, foxes and ghost crabs. Other potential threats include human disturbance to nesting females at night and hatchling disorientation caused by artificial lights.

The South Carolina Department of Natural Resources (SCDNR) issues permits for activities involving marine turtles in South Carolina under the authority granted through a cooperative agreement with the US Fish and Wildlife Service under Section 6 of the Endangered Species Act. Activities covered under this jurisdiction include nest monitoring and the handling of stranded turtles.

Primarily the Park Interpreter along with trained permitted volunteers will carry out all management activities involving marine turtles in coordination with SCDNR biologists. The state park sea turtle management program includes nest monitoring, protection and public education. All management actions will be done in accordance with the SC Department of Natural Resources': Guidelines for Marine Turtle Permit Holders, Nest Protection and Management. Staff involved in management is expected to attend the annual marine turtle workshop hosted by SCDNR and present current data and findings. Management includes the following steps.

*Nest Monitoring Program* – The beach should be patrolled shortly after sunrise each morning during egg-laying season (May 15$^{th}$ – August 15$^{th}$) to check for signs of nesting activity. Each possible nest should be marked, mapped and a record made of the date laid and the projected hatch date. Nest monitoring efforts should increase as hatch date approaches to increase the assurance of successful hatching. When possible, a record will be made of the number of emerged hatchlings, unhatched eggs and the date of hatching.

Prior to each nesting season the entire beach will be delineated at 1/10-mile intervals using 1" x 4" x 4' boards. These reference markers should have an orange background with black numbers. Begin placing reference markers at the boarder of North Litchfield and the park and proceed north. Every nest and false crawl will be referenced, in yards or feet, to these numbered markers (i.e. marker 15 is 1.5 miles North of North Litchfield).

Nesting surveys will not be conducted at night unless specifically authorized by SCDNR and due to heavy egg predation. Early morning surveys prevents disturbance of approaching turtles.

Nest probing is to be carried out only by the primary permit holder who is specifically trained by SCDNR for that purpose. Nest probing is sometimes done in order to determine the precise location of the egg chamber.

All false crawls will be documented and referenced to closest 1/10-mile marker. The frequency and spatial information is extremely valuable in determining the severity of possible anthropogenic disturbance to nesting marine turtles and defining areas along the beach that are not conducive to nest construction.

*Nest Protection Program* – All loggerhead nests will be marked and signed so to better protect them from human-related injury and for easier location during monitoring. Re-location of turtle nests will only be done as a last resort and when nests are threatened by imminent danger such as inundation from seawater. Moving eggs may adversely affect natural incubation and can disrupt egg membranes, thus causing death to the embryo.

In public use areas, nests will be marked in a conspicuous manner using wooden stakes and surveyor's ribbon, arranged to form a square around the egg chamber. A sign marker, identifying the number of eggs-laid (if nest was relocated), date and nest number for that given year will be placed immediately seaward of each nest site.

A self-releasing screen should be placed over each nest to protect eggs from predators such as foxes and raccoons. The screen must be either 2" X 4" or 4" X 4" wire mesh, staked on the corners and large enough to prevent predators from reaching the egg chamber from the side. Self-releasing screens should be inspected regularly, particularly when the eggs are due to hatch to ensure that hatchlings are not trapped.

If nest relocation is necessary, special authority must be granted by SCDNR. It is important that all relocated nests be moved within a few hours of egg deposition (no later than 12 hours). It is critical that all nests be moved to nearby suitable habitat, in areas of little or no vegetation and above the high tide level. If nests have to be moved, all SCDNR guidelines will be strictly adhered to (see SCDNR Guidelines for Marine Turtle Permit Holders, Nest Protection Management).

*Hatchling Assistance Program* – Hatchlings should be allowed to emerge from the nest and make their crawl across the beach unhindered. In some instances however, hatchlings may require assistance in order to successfully emerge from the nest and reach the ocean without significant mortality. False horizons (nearby artificial lights) may confuse hatchlings, causing them to wander away from the ocean.

*All nest inventories will be conducted at dusk. Nests are excavated and data collected at 72 hours after hatching or, if no sign of hatching is observed, at 75 days of incubation. Disoriented hatchlings or those found in the bottom of excavated nests at night should be released immediately. Hatchlings found during the day must be held in a dark container placed with damp sand and released later that same evening. Do not release hatchlings during the day.*

When released, hatchlings must be allowed to crawl to the water by themselves. Studies have shown that this is an important part of the imprinting process.

Hatchlings rescued during the day should be held in containers lined with damp sand, not in water. It is important not to handle or disturb hatchlings until they are released.

Any artificial beach lighting that disorients hatchlings should be reported immediately to SCDNR, SCUTE and Santee Cooper. These incidents can be reduced or eliminated by shielding lights or by seeking enforcement of the beach lighting ordinance.

*Public Education Program* – The park staff will seek to further protect marine turtles and their environment through an active education program aimed at increasing the public's awareness and appreciation of this natural resource. This will be accomplished through a combination of interpretive presentations and walks, distribution of printed materials and educational signs, as well as daily contact with visitors, stressing the importance of their actions at the park during the nesting season. In addition, the park staff will comply with the 1989 Georgetown County Beach Light Ordinance during turtle nesting season by actively participating and encouraging others to join "lights out" campaigns, aimed at reducing artificial lighting that disturb marine turtles.

Huntington Beach State Park also has a long history of working with the South Carolina United Sea Turtle Enthusiast (SCUTE) a Horry and Georgetown volunteer marine turtle conservation network. Each spring we hold workshops designed to train local volunteers to identify and report marine turtle nesting. Currently SCUTE volunteers survey the beaches North of Winyah Bay to the North Carolina border, current membership exceeds 100 volunteers.

*Data Collection Program* – The principal permit holder is required to submit a nesting summary report to SCDNR immediately after nesting, followed by a detailed report each season. Data to be collected includes the number of nests, egg-laying dates, incubation periods and when available number of eggs-laid, hatching success and known predation. SCDNR guidelines provide information on how to evaluate nesting success (see sample SCUTE turtle data sheet). Huntington Beach will first submit all marine turtle nesting data to SCUTE during and at the end of each nesting season. This information is then presented to SCDNR covering all nesting within the SCUTE network area.

*Sea Turtle Stranding Program* – All permit holders participating in the South Carolina Marine Turtle Stranding and Salvage Program are required to submit a report to the Sea Turtle Stranding and Salvage Network for each finding. Participants in this program must be experienced and well trained. Any observations or findings of stranded marine turtles at the park will be immediately reported immediately to SCDNR or persons permitted under this program (see SCDNR Guidelines for Marine Turtle Permit Holders, Stranding and Salvage).

# APPENDIX B